

Class.....639.73.....

Number.....N53.....

Volume.....1 cap. 2.....

Source.....

Received.....

Cost.....

Accession No.....14101.....









NEW HAMPSHIRE COLLEGE

AGRICULTURAL EXPERIMENT STATION

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THE CODLING MOTH AND THE APPLE MAGGOT

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The two most destructive insects affecting the fruit of the apple in New Hampshire are the Codling Moth or Apple Worm and the Apple Maggot or Railroad Worm. These pests greatly lessen the value of the apple crop in the state, and are among the most important enemies of our agriculture. The first named insect—the Codling Moth—has apparently been about as injurious as at present during the last twenty years, but the last named—the vexatious Railroad Worm—is undoubtedly increasing in destructiveness from year to year.

THE CODLING MOTH

*Carpocapsa pomonella*

For more than a century the Codling Moth has preyed upon the fruit of American orchards, into which it was introduced from Europe early in our history. Its life-history, briefly summarized, is this: The parent insect is a small, chocolate brown moth (Fig. 1, *g*), scarcely half an inch long, which appears among the trees in spring about the time the apples are forming from the blossom. Here in the cavity at the upper end of the upright fruit the female moth deposits an egg. In a short time this egg hatches into a small, whitish worm, which nibbles at the skin of the young fruit, finally biting through and eating its way to the core. Here it continues feeding as the apple

develops, gradually increasing in size until at the end of three or four weeks it is about three fourths of an inch long, and of the general form represented in Fig. 1, *e*. Having now fin-

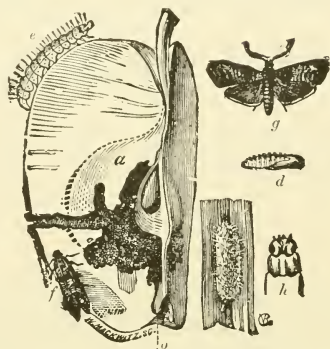


FIG. 1. Codling Moth: *a*, injured apple; *b*, place where egg is laid; *e*, larva; *d*, pupa; *i*, cocoon; *g*, *f*, moth; *h*, head of larva. (After Riley.)

ished its caterpillar growth, it leaves the apple and seeks some crevice in the bark, where it spins a rather slight silken cocoon, in which it changes to the quiet pupa or chrysalis state. In this pupal condition it takes no food but the tissues of the body undergo the wonderful transformation by which the worm is changed to the moth. Two or three weeks after the cocoon was made the insect comes out as a moth, like the one which laid the egg in the blossom end of the young apple. These moths commonly lay eggs for a second brood of worms, that develop in the apples throughout the late summer and early autumn.

Experiments conducted at this Station during the last few years as well as the experience of thousands of orchardists throughout the United States have demonstrated that the injuries of the Codling Moth may be prevented by spraying the trees with Paris green, mixed with water. By means of the spraying machine the fruit grower is able to place in the blossom ends of the young apples a few particles of poison, so that when the newly-hatched

worm nibbles at the skin, it is likely to eat one of these particles and be killed. To accomplish this purpose the orchardist mixes four or five ounces of Paris green in a barrel holding forty or fifty gallons of water, and then having the barrel in a wagon, he drives along the rows of trees, just after the blossoms have fallen off, and sprays them by means of a force pump and spray nozzle. The little particles of poison are thus distributed over the tree in a fine mist, and when the water in which they are suspended evaporates, they are left high and dry upon the leaves and fruit, where under favorable conditions they remain for several weeks a menace to insect enemies, until the combined action of rain and dew, wind and sunshine, dissipates their poisonous properties. The first brood of worms being thus destroyed, the development of the second brood is checked.

The spraying is done when the apples are from the size of a pea to the size of a hickory nut. Two, and in case of very wet weather three, applications are advisable. Paris green is almost insoluble in water, but there is often a small percentage of it soluble, and to prevent the injury this may do to foliage it is advisable to add a quart or two of fresh lime water, made by slaking fresh lime in water, to each barrel of the spraying mixture. Or the Paris green may be used in combination with the Bordeaux mixture.

The philosophy of spraying for the Codling Moth rests upon the fact that the egg is laid upon the outside of the fruit, and consequently the young worm has to nibble through the skin.

#### THE APPLE MAGGOT OR RAILROAD WORM

##### *Trypeta pomonella*

This is the most troublesome apple pest in the state, and as already intimated it is increasing in destructiveness from year to year. The injury of this insect is at once distinguished from that of the Codling Moth by the fact that while the latter is largely confined to the region of the core, the Apple Maggot feeds indiscriminately through the pulp of the fruit, burrowing in every direction. The larvæ which do the damage are themselves also different, that of the Codling Moth having six legs while the Apple Maggot is footless.

The parent of the Apple Maggot is a two-winged fly that appears early in summer and deposits eggs in the partially grown apples. These eggs are inserted one in a place, through the skin of the fruit. In a few days each hatches into a mag-

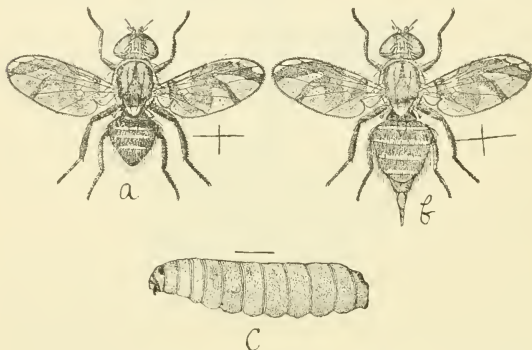


FIG. 2. The Apple Maggot or Railroad Worm : *a*, Fly, male ; *b*, Fly, female *c*, larva. Magnified. (*After Comstock and Harvey.*)

got that tunnels the fruit in all directions, becoming full-grown in five or six weeks, when it is whitish or greenish white, and about a quarter of an inch long. The maggot then leaves the apple and generally goes into the soil an inch or less where it changes to the pupa. The insects remain in this condition until the following summer, when they emerge as flies again.

The most careful observations upon the life-history of the Railroad Worm have been made by Professor F. L. Harvey of the Maine State College. As the conditions in New Hampshire are practically the same as in Maine, I quote the following account of the details of the insect's life-history written by Professor Harvey :

"In early seasons, under favorable conditions, the flies in Maine begin to emerge about July 1, and earlier in the states farther south. They continue to emerge all summer and are on the wing in abundance until the middle or last of September and occasionally in October. Early frosts check them. The

flies lived three weeks in confinement, and will probably live longer in nature. They begin to deposit their eggs in the early fruit by July 1, or earlier, and egg laying continues while the flies are on the wing, the earlier races of flies affecting the earlier varieties, and the later races the fall and winter fruit. Each female is capable of laying, at least, between three and four hundred eggs, which are inserted from time to time, one in a place, by means of a sharp ovipositor through the skin of the apple. The eggs being successively developed in the ovary of the female, after the manner of the eggs of the barnyard fowl, the season of egg laying extends over considerable time. The eggs are vertically inserted into the pulp of the apple, with the end opposite the pedicel, which contains the head of the maggot, pointing toward the core. The eggs are deposited in all parts of the apple, usually upon the cheeks, sparingly near the calyx and stem ends, and more abundantly upon the pale or shaded side of the fruit. The time required to deposit the egg is about one-half minute. By means of the sharp ovipositor a characteristic puncture, 33 m m. (.0133 in.) diameter, is made through the skin of the apple. These punctures can be detected

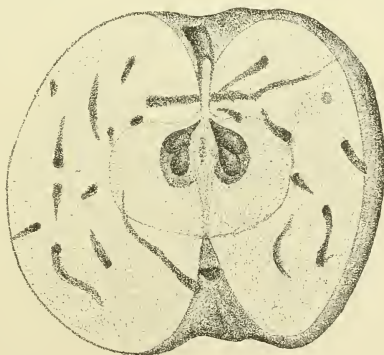


FIG. 3.—Section of apple injured by Apple Maggot or Railroad Worm.

by careful observations with the naked eye, but a pocket lens is necessary to see them well. They appear as brownish specks,

and have not been before distinguished from the brownish, rusty spots common on apples. Under the glass they appear as circular or oblong openings, surrounded by a brownish border, somewhat shrunk by the shriveling of the tissue beneath. They may be numerous on the same apple. The eggs hatch in four or five days under favorable conditions and the minute larvæ begin at once to work in the pulp of the apple. They have no true opposable jaws, but the head is provided with two black curved hooks, situated above the mouth, with which they rasp the pulp of the fruit rapidly by means of a vertical movement of the head. They live upon the juice of particles of apple thus detached, which is sucked into the mouth. The pulp is rejected and turns brown. They can burrow their length in soft fruit in less than a minute. The channels made by the young larvæ, while the fruit is still growing, are largely healed, and neither they nor the minute white larvæ are liable to be detected by the naked eye or by the casual observer. As the larvæ grow, and the fruit matures, the enlarged channels do not heal, but turn brown, and the presence of the maggots is then readily detected. These channels meander through the whole fruit, even the core. They often cross each other, enlarge as the larvæ grow, and in the last stages of the maggot's work run together, producing large cavities. Finally they involve the whole fruit, rendering it a worthless mass of disgusting corruption, held together by the peel."

In regions where this insect is not very abundant, fall apples with thin skins are most likely to be attacked, but when the pest becomes more numerous the injury extends to other varieties.

The only thorough-going method of checking the increase of the Railroad Worm and preventing injury to the fruit is to gather and destroy the windfalls. The worms are in these, and if left on the ground the maggots leave the apples and burrow into the earth. By picking up the windfalls every day or every other day and feeding to stock or otherwise destroying them, the insects will be killed and the development of the next year's crop of flies prevented. Each maggot thus destroyed this year lessens by a hundred or more the maggots of next year's brood. The flies are sluggish, and generally remain in the orchard

where they develop, so that each fruit-grower, to a large extent, can protect himself without the fear of invasion from neighboring orchards.

If the windfalls are picked up and fed to stock, only give as many at one time as will be eaten up clean. Leaving the apples on the ground in the pasture long enough for the maggots to get out might not help matters much. If no other way of disposing of the surplus is found, dig a hole three or four feet deep and dump the apples in it, until within a foot of the top. Then cover with earth a foot deep. In a well-kept orchard the picking up of windfalls, from the middle of July onward, may readily be accomplished; an active boy or two by going over the ground daily would find it a comparatively simple matter. If preferred, sheep or swine in sufficient numbers to keep the ground clear of fallen apples may be turned loose in the orchard, either part of the time every day or two, or kept in all the while after July 15, if the orchard contains early varieties, and later if only late varieties are present.

Spraying does not prevent the injuries of the Apple Maggot; the eggs are deposited beneath the skin of the fruit out of the reach of insecticides. The destruction of windfalls, and general clean culture is the best way of keeping the Railroad Worm in check.











63973 N53 1 cap

New Hampshire

Bulletins 1-48

